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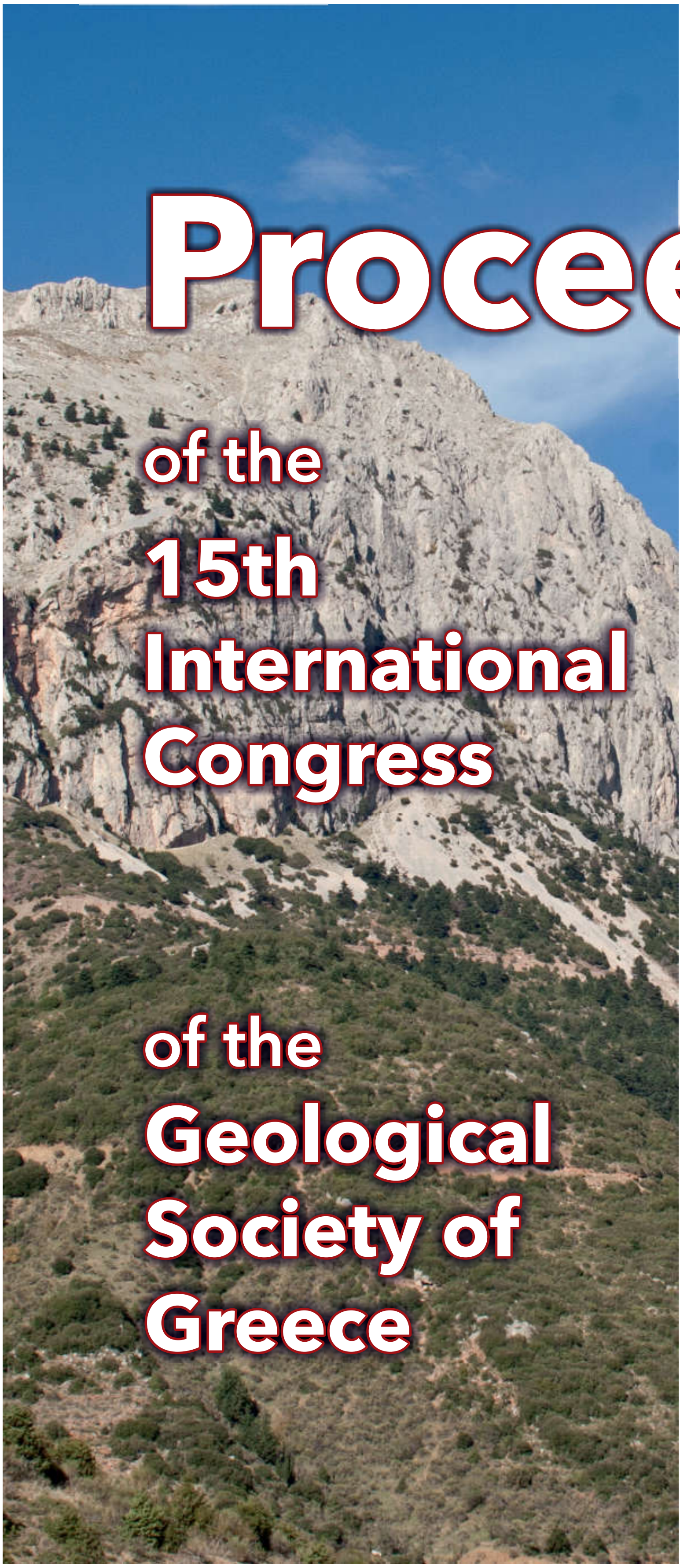


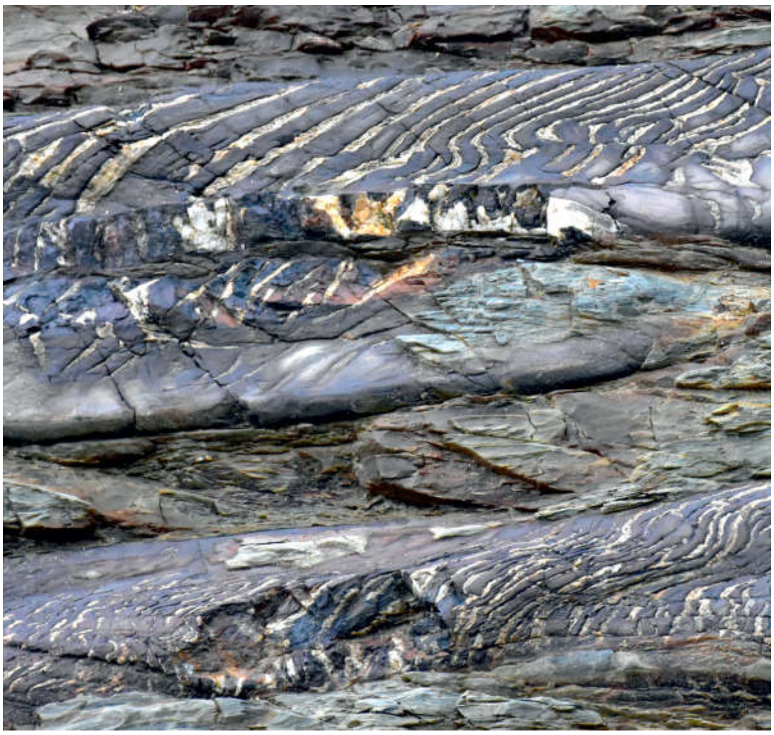
Proceedings of the 15th International Congress of the Geological Society of Greece

ΕΓΕ 2019

15th International Congress of the Geological Society of Greece

Athens, 22-24 May 2019

EXPLORING AND PROTECTING OUR LIVING PLANET EARTH



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Contemporary Kinematics of the South Aegean Area Detected with Differential GNSS Measurements

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The south Aegean Sea and its adjacent areas is a highly segmented tectonically active domain, characterized by high-rate extension and severe crustal thinning. The different segments (blocks) that make up the south Aegean crust are bounded by significant fault zones and/or dislocation surfaces whose their relative motion varies in size and direction. The present study studies the kinematic characteristics of the southern Aegean crustal segments using geodetic data of 47 permanent GNNS stations distributed over the eastern Peloponnesus, Attica, Cyclades, Dodecanese, Crete and the coast of western Anatolia.

The data used herein comprise:

- Primary (unprocessed/raw) data from 24 permanent stations operated by METRICA S.A. (https://www.metrica.gr), spanning the period 2011-2018 and generously provided by said organization.
- Primary data, from 8 stations of the HEPOS (Hellenic Positioning System) facility, Hellenic National Cadaster (http://www.hepos.gr), spanning the period 2013-2017 and generously provided by said organization.
- Primary data from one station, operated by the RING network of Italy (Rete Integrata Nationale GPS - http://ring.gm.ingv.it), spanning the period 2017-2018.
- Primary data from one station operated by UNAVCO (https://www.unavco.org/), spanning the period 2011-2017.

All primary data were processed with the Bernese v5.2 software (Dach et al., 2007**)**.

- Processed data (displacement time series) from 4 stations operated by the Geodetic Laboratory of Nevada, spanning the periods 2009-2018 (http://geodesy.unr.edu/NGLStationPages/gpsnetmap/GPSNetMap_MAG.html).
- Velocity vectors from 7 stations located in Attica and Peloponnesus, extracted from Chousianitis et al., (2013) and spanning a period of approx. five years.
- Velocity vectors from 2 stations operated by the National Technical University of Athens (NTUA), spanning the period 2012-2015 and kindly provided by Dr. J. Galanis (personal communication, 2018).

Hitherto studies of the kinematics of the Aegean Plate have mainly focused on the analysis of the regional strain field and large-scale relative motion between the Aegean, Anatolian and Eurasian plates, either using the ITRF coordinate frame or remote poles of rotation located in Western Europe or Africa. This approach does not facilitate discrimination of local-scale relative motion between tectonic blocks. Inasmuch as we are mainly interested in studying *local-scale* effects in the south and eastern Aegean region, we have based our analysis on a *local* reference point situated at Anavyssos, Attica and indicated with a red square in Fig.1.

Given the reference point, it is apparent that to the west of longitude 24°E, relative block motion is somewhat uncertain because the majority of estimated relative velocities are associated with large errors. Nevertheless, at least four well estimated vectors clearly indicate that the eastern Peloponnese slides in a roughly N210°–N220° direction, expectedly and approximately normal to the strike of the western half of the Hellenic Trench.

Eastward of longitude 24°E things appear to be quite different; the errors associated with the relative velocity vectors are rather small and the distribution of velocities allows the identification of four and tentatively five major blocks with different kinematics, whose boundaries are illustrated in Fig. 1 with blue dashed lines. Thus:

- Block 1 (Cyclades) experiences approximately N220° dislocation at an average velocity of 1.48 mm/yr.
- Block 2 (soth-western Cyclades) experiences approximately N210° dislocation at average velocity of 3.25 mm/yr.
- Block 3 (northern Dodecanese) experiences approximately N150° dislocation at an average velocity of 3.02 mm/yr.
- Block 4 (Cretan Sea/Crete) experiences approximately N160° dislocation at an average velocity of 2.00 mm/yr.
- Block 5 (southern Dodecanese) experiences approximately N120° dislocation at an average velocity of 7.35 mm/yr.

According to this kinematic setting, the relative horizontal motion between individual blocks is as follows:

- *Left-lateral* between Blocks 1/ 2 and the area extending beyond their northern boundaries (marked as “Block 6” in Fig. 1).
- *Left-lateral* between Blocks 1 and 3.
- *Right-lateral* between Blocks 1 and 2.
- *Extension* (divergence) in an approx. N-S direction between Blocks 2/ 3 on one hand, and 4/ 5 on the other. The onset of the divergence coincides with the onset of severe crustal thinning in the Cretan Sea
- *Unknown* between tentative Blocks 4 and 5 which appear to be distinguished by the *very* significant difference in the velocities observed between Crete on one hand and the Dodecanese islands on the other.

In conclusion, the area of the south Aegean appears to exhibit a rather complex kinematic pattern, the origin of which remains to be confirmed and validated with future research.

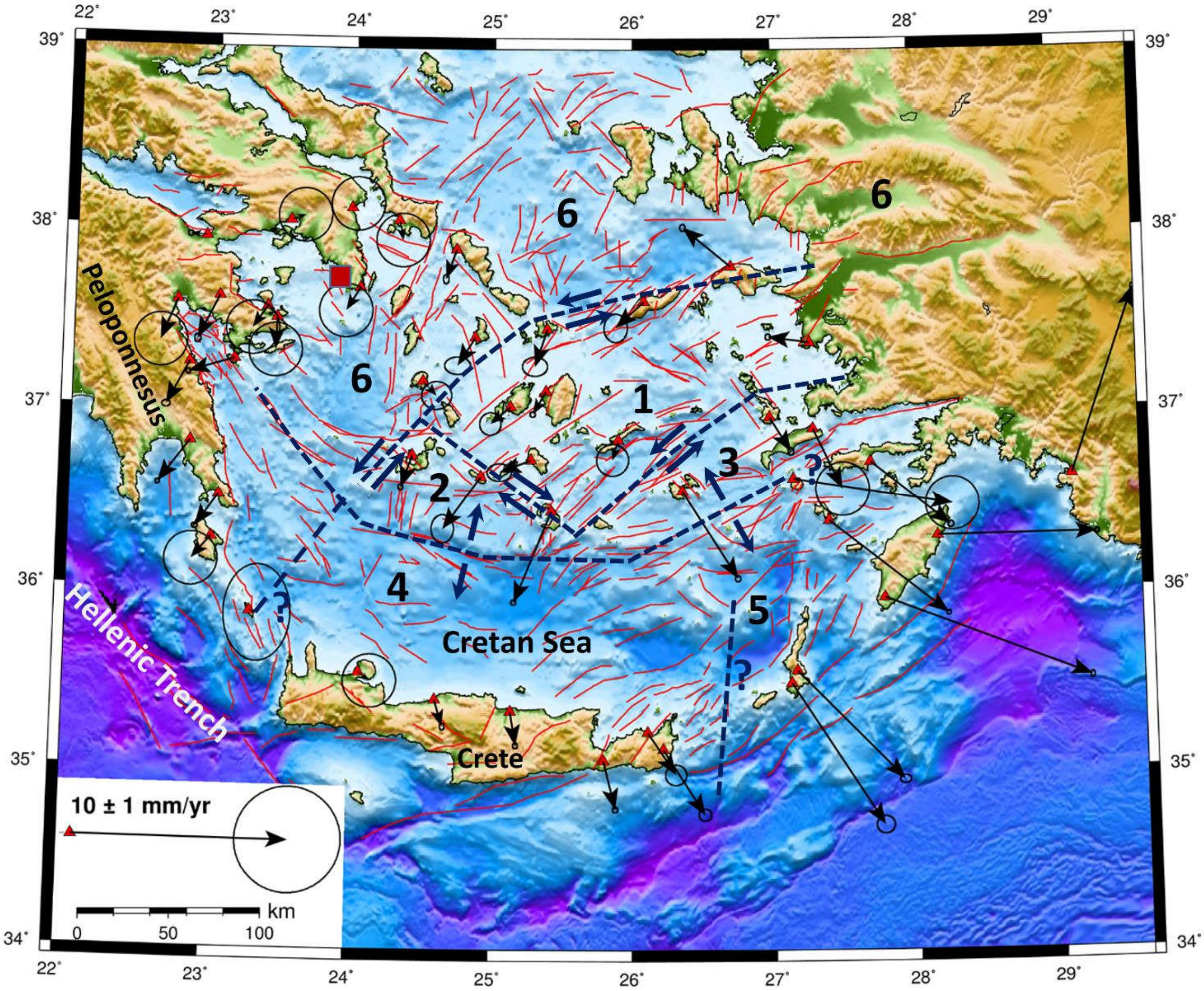

Figure 1. Velocity vectors relative to Anavyssos station (red square); ellipses at the tips of the vectors indicate the 95% confidence region. Blue dashed lines indicate the boundaries of the kinematic discontinuities identified herein. Known or inferred faults are shown with red lines; information was extracted from Sakellariou and Tsampouraki (2019), Kokkalas and Aydin (2013) and IGME (1989). The bathymetry was extracted from the EMODNet (2016) data base.

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